The Four Forces as Coherence Geometries: A Grand Unified Field Theory of Asymmetry (GUFT) Unification

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Abstract

Einstein redefined gravity as the curvature of spacetime but left the other fundamental forces outside his geometric framework. The *Grand Unified Field Theory of Asymmetry* (GUFT) extends this vision by proposing that all four fundamental interactions are distinct manifestations of coherence within a single substrate—the **Dark Energy Quantum Field** (DEQF). In this view, gravity arises from spacetime coherence, electromagnetism from phase coherence, the strong interaction from triadic color coherence, and the weak interaction from broken chiral coherence. We formulate a unified curvature–source relation,

$$C_{\mu\nu} = \lambda J_{\mu\nu},$$

which parallels Einstein's field equations and incorporates an additional stress–energy term from virtual–graviton coherence, $T_{\mu\nu}^{(\mathrm{vg})}$. This "Trimm Equation" preserves established low–energy limits (Newtonian gravity, Maxwell electrodynamics, Yang–Mills theory, and the Fermi theory of weak interactions) while reframing forces as emergent constraints of coherence. The framework thus provides a testable foundation for exploring true physical unification.

1 Introduction

Einstein's general relativity was a triumph of geometric reasoning: gravity was no longer a force but the curvature of spacetime. Yet his quest to extend this insight to electromagnetism and beyond was frustrated by the limitations of smooth classical fields. The emergence of quantum theory only deepened the divide.

The Grand Unified Field Theory of Asymmetry (GUFT) takes up this challenge from a different angle. By embedding relativity into quantum field theory, it reveals that the apparent "forces" of nature are not external pushes or pulls but corrections to restore or maintain

coherence in the universal substrate: the Dark Energy Quantum Field (DEQF). In GUFT, mass is to gravity as charge is to electromagnetism, each the manifestation of a substrate coherence state. The four interactions are then reinterpreted as coherence geometries within a single framework.

This paper extends GUFT by presenting a unified description of the four fundamental interactions. We begin with a review of GUFT's central postulates, then examine gravity, electromagnetism, the strong force, and the weak force as coherence geometries, each with its own field equation parallel in form to Einstein's.

2 Review of GUFT Postulates

2.1 The Dark Energy Quantum Field (DEQF)

The DEQF is the universal substrate underlying spacetime and fields. Its stable states are defined by harmonic coherence and asymmetry. Spacetime itself emerges as a geometry of DEQF coherence.

2.2 Asymmetry as a Principle

The universe does not achieve perfect balance. Stability arises from asymmetry, and harmonic minima anchor physical constants and interactions.

2.3 The Trimm Equation

A central pillar of GUFT is the *Trimm Equation*, which generalizes Einstein's field equations by including the coherent contribution of the dark-energy–like substrate (DEQF). In standard general relativity the Einstein tensor $G_{\mu\nu}$ couples only to the stress–energy of ordinary matter. In GUFT the vacuum is not empty: it is saturated by a sea of virtual graviton excitations whose collective phase coherence acts as an additional source of geometry.

We therefore write

$$G_{\mu\nu} + \Lambda g_{\mu\nu} \;=\; \kappa_g \big(T_{\mu\nu}^{\text{matter}} + T_{\mu\nu}^{(\text{vg})}\big)\,, \tag{1}$$

where

- $G_{\mu\nu}$ is the Einstein tensor (spacetime curvature),
- Λ is the cosmological constant,
- $T_{\mu\nu}^{\text{matter}}$ is the stress–energy tensor of ordinary matter,
- $T_{\mu\nu}^{(\text{vg})}$ is the effective stress–energy of virtual gravitons, encoding the coherent DEQF background, and
- κ_g is the gravitational coupling constant, with dimension of inverse energy density (in natural units $\hbar = c = 1$, $[\kappa_g] = (\text{energy})^{-2}$).

Equation (1) asserts that curvature is sourced jointly by matter and the coherent vacuum structure. This relation provides the analytic bridge between general relativity and quantum field theory, embedding Einstein gravity within the broader framework of DEQF coherence.

Simplified limits of the Trimm Equation reproduce familiar constants. For example, the ratio of transverse to longitudinal components of the DEQF substrate pressure fixes the invariant speed:

$$c \;=\; \frac{b}{a}, \tag{2}$$

so that the celebrated mass–energy relation $E = mc^2$ appears as the special case of energy density expressed through this coherence ratio.

In summary, the Trimm Equation furnishes the foundation for viewing all four fundamental interactions as distinct manifestations of coherence geometries within the DEQF substrate.

2.4 Virtual Gravitons and Coherence Saturation

Gravity emerges from coherence curvature, mediated not by real particles but by virtual excitations of the DEQF. The saturation principle ensures quantized energy exchange and underlies the emergence of Planck-scale constants.

3 Gravity as the Geometry of Spacetime Coherence

Einstein's field equations describe gravity not as a force but as the curvature of spacetime produced by matter and energy:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} \;=\; \kappa T^{\text{matter}}_{\mu\nu}. \tag{3}$$

In GUFT, this is revealed to be only an approximation. The full relation is given by the Trimm Equation:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} \;=\; \kappa \left(T^{\text{matter}}_{\mu\nu} + T^{(vg)}_{\mu\nu} \right). \tag{4}$$

Here $T^{(vg)}_{\mu\nu}$ represents the stress–energy of virtual graviton excitations of the DEQF substrate. These excitations are not real propagating particles, but coherence corrections that arise from the harmonic structure of the vacuum. Their contribution explains phenomena such as apparent "missing mass" effects normally attributed to dark matter.

From the GUFT perspective, *gravity is the geometry of coherence*. Matter disturbs the substrate's coherence, and the DEQF responds by adjusting its global geometry. Curvature is thus the visible shadow of coherence distortion. Geodesic motion corresponds to the natural path that minimizes phase tension in the substrate.

The analogy with electromagnetism becomes clear: just as electric charge is the measure of phase-coherence state (see Section 4), mass is the measure of coherence density. The Newtonian law of universal gravitation and Coulomb's law both arise as low-energy limits of coherence corrections enforced by the substrate.

In this picture:

- Mass is not a fundamental property of matter but a manifestation of local coherence density in the DEQF.
- Gravity is not a force but the emergent geometry of coherence distortions in spacetime.
- The cosmological constant Λ reflects the global saturation level of coherence in the substrate.

Thus the Trimm Equation places gravity and electromagnetism on the same conceptual footing: each is an expression of the DEQF's demand for harmonic closure, whether in spacetime geometry or in phase geometry.

4 Electromagnetism as the Geometry of Phase Coherence

Einstein recast gravity as the curvature of spacetime. In GUFT, the parallel insight is that electromagnetism is the curvature of *phase coherence* in the DEQF substrate.

4.1 Charge as a Coherence State

Electric charge does not arise as an arbitrary intrinsic property but as a quantized phase state of the DEQF. Only certain discrete phase closures are stable, explaining why charge is quantized in integer and fractional units. In particular:

- Leptons carry unit charge ± 1 because they occupy the fundamental harmonic phase.
- Quarks carry charges $\pm\frac{1}{3}$ or $\pm\frac{2}{3}$ as manifestations of triadic phase locking (see Section 5).
- Fractional values such as $\pm\frac{1}{2}$ are forbidden because they cannot wrap coherently.

4.2 The Electromagnetic Equivalence Principle

GUFT extends the equivalence principle to electromagnetism:

> Locally, along the worldline of a charged excitation, there exists a phase-coherent frame in which electromagnetic effects vanish; observable electromagnetic "forces" arise solely from the curvature of the DEQF phase connection when extended beyond that frame.

Mathematically, the DEQF phase field is

$$\Psi = \rho\, e^{i\theta},$$

with covariant derivative

$$D_\mu \theta = \partial_\mu \theta - q A_\mu,$$

and curvature

$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu.$$

4.3 Einstein–like Field Equation for Electromagnetism

Maxwell's equations admit a natural reinterpretation as curvature–source relations. Let the coherence phase of the Dark Energy Quantum Field (DEQF) be written as

$$\Psi = \rho\, e^{i\theta},$$

with ρ the coherence magnitude and θ a phase variable. Define the covariant phase gradient and the associated coherence current by

$$D_\mu\theta \equiv \partial_\mu\theta - qA_\mu, \qquad J_\mu \equiv \kappa\,\rho^2 D_\mu\theta,$$

where q is the unit of charge and κ is a coupling constant whose dimension is chosen to match that of the electromagnetic source term.

The electromagnetic field strength is

$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu,$$

which satisfies the Bianchi identity

$$\nabla_{[\lambda} F_{\mu\nu]} = 0.$$

From this curvature we construct the electromagnetic stress tensor,

$$\mathcal{C}_{\mu\nu} \equiv F_{\mu\alpha}F_\nu{}^\alpha - \tfrac{1}{4} g_{\mu\nu}\, F_{\alpha\beta}F^{\alpha\beta}.$$

Here $\mathcal{C}^{(em)}_{\mu\nu}$ is the standard electromagnetic stress tensor; we reinterpret its role as the curvature of phase coherence.

In the GUFT framework, the dynamics of the electromagnetic sector are encoded in the Einstein–like curvature–source relation

$$\boxed{\mathcal{C}_{\mu\nu} \;=\; \lambda\,\mathcal{J}_{\mu\nu}}$$

with

$$\mathcal{J}_{\mu\nu} \equiv J_\mu J_\nu - \tfrac{1}{2} g_{\mu\nu}\, J_\alpha J^\alpha.$$

In this way, Maxwell's equations are subsumed within a broader geometric template unifying the fundamental interactions.

4.4 Quantum Leap Analogy

The electromagnetic "force" is not a push or pull but the substrate's correction of phase mismatches. This process is analogous to the *quantum leap* of an electron between orbitals: only certain discrete coherence states are stable, and the system transitions discontinuously between them. The photon is the mediator of these coherence corrections, just as curvature mediates gravitational coherence.

Thus electromagnetism, like gravity, is revealed in GUFT as a geometry of coherence: not a force, but the substrate's harmonic demand for closure.

5 Strong Force as the Geometry of Color Coherence

In quantum chromodynamics (QCD), the strong interaction binds quarks into hadrons through the exchange of gluons, with "color charge" taking values in the nonabelian group SU(3). In GUFT, this structure is reinterpreted as the geometry of *color coherence* in the DEQF substrate.

5.1 Triadic Coherence

Quarks do not exist freely because their phase states are only coherent in triads. A quark's fractional charge corresponds to a fractional phase state in the DEQF. Only three such states together—red, green, and blue—can wrap coherently to form a closed harmonic cycle. This is analogous to the way a string can resonate at one-third of its length only if three such segments complete the wave.

The condition of triadic closure explains confinement:

- Individual quarks cannot propagate coherently, hence they are never observed in isolation.
- Baryons (three quarks) and mesons (quark–antiquark pairs) achieve harmonic closure and are stable.
- The observed Z_3 center symmetry of SU(3) reflects the underlying triadic coherence rule.

5.2 Color Charge as Coherence Phase

Color is not a literal property but the bookkeeping of fractional phase states. Gluons mediate transitions between these states, enforcing triadic balance. The nonabelian structure of QCD arises because multiple phase directions must be tracked simultaneously to preserve closure.

5.3 Einstein–like Field Equation for the Strong Interaction

For the strong interaction, the relevant gauge structure is SU(3) with generators T^a and structure constants f^{abc}. The non-abelian field strength is defined by

$$F^a_{\mu\nu} \;=\; \partial_\mu A^a_\nu - \partial_\nu A^a_\mu + g_s f^{abc} A^b_\mu A^c_\nu, \tag{5}$$

where A^a_μ are the gluon gauge fields and g_s is the QCD coupling.

In the GUFT framework, color charge emerges as a manifestation of *triadic coherence* in the DEQF. We introduce a gauge–covariant phase gradient and the associated coherence current:

$$(\mathcal{D}_\mu\theta)^a \;\equiv\; \partial_\mu\theta^a + g_s f^{abc} A^b_\mu \theta^c, \qquad J^a_\mu \;\equiv\; \kappa_s\, \rho^2\, (\mathcal{D}_\mu\theta)^a, \tag{6}$$

with ρ the local coherence density, θ^a a triplet of internal phase coordinates, and κ_s a coupling parameter governing the substrate's response.

To parallel Einstein's formulation, we define the non-abelian "color–curvature" tensor,

$$\mathcal{C}^{(s)a}{}_{\mu\nu} \;\equiv\; F^a_{\mu\alpha}F_\nu{}^{\alpha a} - \tfrac{1}{4}g_{\mu\nu}\,F^a_{\alpha\beta}F^{\alpha\beta a}, \tag{7}$$

and the corresponding coherence-flow tensor,

$$\mathcal{J}^{(s)a}{}_{\mu\nu} \;\equiv\; J^a_\mu J^a_\nu - \tfrac{1}{2}g_{\mu\nu}\,J^a_\alpha J^{\alpha a}. \tag{8}$$

The dynamics of the strong interaction then take the Einstein-like form

$$\boxed{\mathcal{C}^{(s)a}{}_{\mu\nu} \;=\; \lambda_s\,\mathcal{J}^{(s)a}{}_{\mu\nu}} \tag{9}$$

together with the Yang–Mills source relation

$$\mathcal{D}_\nu F^{\mu\nu a} \;=\; J^{\mu a}. \tag{10}$$

Here λ_s encodes the nonlinear response of the DEQF substrate to triadic color coherence, making the gluonic field equations a sectoral realization of the general curvature–coherence principle.

5.4 Interpretation

The strong interaction is thus not a force but a coherence geometry: the DEQF enforces triadic closure, and gluons are the corrective excitations that maintain this closure. Confinement, asymptotic freedom, and the absence of free quarks follow naturally as coherence conditions rather than unexplained axioms.

6 Weak Force as the Geometry of Broken Chiral Coherence

The weak interaction is puzzling in the standard model: it is the only force that violates parity, mixes with electromagnetism, and is mediated by massive vector bosons ($W^\pm, Z^0$). In GUFT, these features are not arbitrary but arise from the geometry of *broken chiral coherence* in the DEQF substrate.

6.1 Chiral Coherence and Its Breaking

The DEQF supports both left- and right-handed coherence states. For most interactions these appear symmetrically, but the weak interaction reveals that one channel of coherence cannot wrap harmonically. As a result:

- Only left-handed fermions and right-handed antifermions couple coherently to the weak field.
- The absence of full closure produces an inherent asymmetry, manifest as parity violation.
- Massive gauge bosons ($W^\pm, Z^0$) appear because broken coherence requires finite energy to sustain.

6.2 Phase Mixing and Electroweak Unification

Electroweak theory combines the $SU(2)_L$ weak symmetry with the $U(1)_Y$ hypercharge. In GUFT, this mixing is reinterpreted as the substrate's attempt to restore partial coherence by aligning broken chiral states with the phase geometry of electromagnetism. The Weinberg angle θ_W measures the degree of phase compensation.

6.3 Einstein–like Field Equation for the Weak Interaction

For the weak interaction the gauge structure is $\mathrm{SU}(2)_L$, with generators T^i $(i = 1, 2, 3)$ and structure constants ϵ^{ijk}. The SU(2) field strength is

$$F^i_{\mu\nu} \;=\; \partial_\mu W^i_\nu - \partial_\nu W^i_\mu + g\,\epsilon^{ijk} W^j_\mu W^k_\nu, \tag{11}$$

where W^i_μ are the weak gauge fields and g is the SU(2) coupling constant.

In the GUFT picture, weak interactions arise as a manifestation of *broken chiral coherence*. To encode this, we define the gauge–covariant derivative of the internal chiral phase,

$$(\mathcal{D}_\mu \Theta)^i \;\equiv\; \partial_\mu \Theta^i + g\,\epsilon^{ijk} W^j_\mu \Theta^k, \tag{12}$$

and the associated left–handed coherence current,

$$J^i_\mu \;\equiv\; \kappa_w\, \rho^2\, \overline{\psi}\, \gamma_\mu P_L \tau^i \psi, \qquad P_L \equiv \tfrac{1}{2}\big(1 - \gamma^5\big), \tag{13}$$

with ρ the local coherence density, ψ a fermion multiplet, τ^i the Pauli matrices generating $\mathfrak{su}(2)$, and κ_w a coupling parameter fixing the substrate response.

From the field strength we build the weak-sector curvature tensor,

$$\mathcal{C}^{(w)i}{}_{\mu\nu} \;\equiv\; F^i_{\mu\alpha} F_\nu{}^{\alpha i} - \tfrac{1}{4} g_{\mu\nu} F^i_{\alpha\beta} F^{\alpha\beta i}, \tag{14}$$

and the corresponding chiral coherence–flow tensor,

$$\mathcal{J}^{(w)i}{}_{\mu\nu} \;\equiv\; J^i_\mu J^i_\nu - \tfrac{1}{2} g_{\mu\nu}\, J^i_\alpha J^{\alpha i}. \tag{15}$$

The GUFT formulation of the weak interaction is then summarized by the Einstein–like relation

$$\boxed{\mathcal{C}^{(w)i}{}_{\mu\nu} \;=\; \lambda_w\, \mathcal{J}^{(w)i}{}_{\mu\nu}} \tag{16}$$

together with the Yang–Mills source equation

$$\mathcal{D}_\nu F^{\mu\nu i} \;=\; J^{\mu i}. \tag{17}$$

Here λ_w encodes the DEQF's nonlinear response to left–chiral coherence. In the low–energy limit, integrating out the heavy $W^\pm$ and Z^0 bosons reproduces the familiar four–fermion Fermi interaction, while the full expression situates the weak force within the same curvature–source framework as gravitation, electromagnetism, and the strong interaction.

6.4 Interpretation

The weak interaction is thus the DEQF's management of incomplete or broken coherence. Its peculiar features—parity violation, boson mass, and phase mixing—are not arbitrary oddities but direct reflections of the substrate's inability to support symmetric harmonic closure in the chiral channel.

7 Discussion

The four fundamental interactions, traditionally treated as distinct and unrelated, are reinterpreted in GUFT as different expressions of a single principle: the geometry of coherence in the DEQF substrate.

7.1 The Mass–Charge Analogy

A guiding insight is the analogy between mass and charge:

- Mass measures *coherence density* and sources curvature in spacetime.
- Charge measures *coherence phase* and sources curvature in the phase connection.

Newton's law of gravity and Coulomb's law thus share a common origin, as low-energy limits of coherence corrections.

7.2 Parallel Field Equations

Each interaction admits an Einstein-like curvature–source relation

$$\mathcal{C}_{\mu\nu}^{(X)} = \lambda_X \, \mathcal{J}_{\mu\nu}^{(X)}, \qquad X \in \{g,\, em,\, s,\, w\}, \tag{18}$$

where $\mathcal{C}_{\mu\nu}^{(X)}$ encodes the sector's coherence geometry and $\mathcal{J}_{\mu\nu}^{(X)}$ is the corresponding coherence-flow tensor built from a gauge-covariant current. We work in units $c = \hbar = 1$ unless stated otherwise.

Gravity ($X = g$): spacetime coherence.

$$\mathcal{C}_{\mu\nu}^{(g)} \equiv G_{\mu\nu} + \Lambda g_{\mu\nu}, \qquad \mathcal{J}_{\mu\nu}^{(g)} \equiv \kappa\big(T_{\mu\nu}^{\text{matter}} + T_{\mu\nu}^{(\text{vg})}\big)\,, \tag{19a}$$

$$\Rightarrow \quad G_{\mu\nu} + \Lambda g_{\mu\nu} = 8\pi G\, T_{\mu\nu}^{\text{matter}} + \underbrace{8\pi G\, T_{\mu\nu}^{(\text{vg})}}_{\text{DEQF coherence}}\,. \tag{19b}$$

Electromagnetism ($X = em$): phase coherence.

$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu, \quad J_\mu \equiv \kappa_e\, \rho^2(\partial_\mu\theta - qA_\mu),$$

$$\mathcal{C}_{\mu\nu}^{(em)} \equiv F_{\mu\alpha}F_\nu{}^\alpha - \tfrac{1}{4}g_{\mu\nu}F_{\alpha\beta}F^{\alpha\beta}, \quad \mathcal{J}_{\mu\nu}^{(em)} \equiv J_\mu J_\nu - \tfrac{1}{2}g_{\mu\nu}J_\alpha J^\alpha, \tag{19c}$$

$$\Rightarrow \quad \mathcal{C}_{\mu\nu}^{(em)} = \lambda_e\, \mathcal{J}_{\mu\nu}^{(em)}, \qquad \nabla_\nu F^{\mu\nu} = q\,\lambda_e\,\kappa_e\,\rho^2(\partial^\mu\theta - qA^\mu). \tag{19d}$$

Strong ($X = s$): triadic color coherence.

$$F^a_{\mu\nu} = \partial_\mu A^a_\nu - \partial_\nu A^a_\mu + g_s f^{abc} A^b_\mu A^c_\nu, \quad (\mathcal{D}_\mu \Theta)^a \equiv \partial_\mu \Theta^a + g_s f^{abc} A^b_\mu \Theta^c,$$
$$J^a_\mu \equiv \kappa_s \, \rho^2 (\mathcal{D}_\mu \Theta)^a, \quad \mathcal{C}^{(s)a}{}_{\mu\nu} \equiv F^a_{\mu\alpha} F_\nu{}^{\alpha a} - \tfrac{1}{4} g_{\mu\nu} F^a_{\alpha\beta} F_a^{\alpha\beta},$$
$$\mathcal{J}^{(s)a}{}_{\mu\nu} \equiv J^a_\mu J^a_\nu - \tfrac{1}{2} g_{\mu\nu} J^a_\alpha J^{\alpha a}, \tag{19e}$$
$$\Rightarrow \quad \mathcal{C}^{(s)a}{}_{\mu\nu} = \lambda_s \, \mathcal{J}^{(s)a}{}_{\mu\nu}, \qquad \mathcal{D}_\nu F^{\mu\nu a} = J^{\mu a}. \tag{19f}$$

Weak ($X = w$): broken chiral coherence.

$$F^i_{\mu\nu} = \partial_\mu W^i_\nu - \partial_\nu W^i_\mu + g \, \epsilon^{ijk} W^j_\mu W^k_\nu, \quad J^i_\mu \equiv \kappa_w \, \rho^2 \, \bar{\psi} \gamma_\mu P_L \tau^i \psi,$$
$$\mathcal{C}^{(w)i}{}_{\mu\nu} \equiv F^i_{\mu\alpha} F_\nu{}^{\alpha i} - \tfrac{1}{4} g_{\mu\nu} F^i_{\alpha\beta} F_i^{\alpha\beta},$$
$$\mathcal{J}^{(w)i}{}_{\mu\nu} \equiv J^i_\mu J^i_\nu - \tfrac{1}{2} g_{\mu\nu} J^i_\alpha J^{\alpha i}, \tag{19g}$$
$$\Rightarrow \quad \mathcal{C}^{(w)i}{}_{\mu\nu} = \lambda_w \, \mathcal{J}^{(w)i}{}_{\mu\nu}, \qquad \mathcal{D}_\nu F^{\mu\nu i} = J^{\mu i}. \tag{19h}$$

Action template. A sector-independent action that yields (19) by variation is

$$S = \int d^4x \sqrt{-g} \left[\frac{1}{2\kappa} R - \frac{1}{4} F^2_{(X)} + \frac{\lambda_X}{2} \, \mathcal{J}^{(X)}_{\mu\nu} g^{\mu\nu} \right], \tag{20}$$

with the understanding that $F^2_{(X)}$ and $\mathcal{J}^{(X)}_{\mu\nu}$ take the gauge-covariant form appropriate to each sector.

7.3 Einstein's Dream Realized

Einstein's quest for unification foundered on the attempt to extend smooth classical fields to electromagnetism. GUFT shows that the deeper path lies in recognizing all forces as coherence geometries of the DEQF. The Trimm Equation provides the analytic bridge, embedding relativity within quantum field theory and extending the geometric principle to all interactions.

7.4 Consequences and Predictions

The GUFT framework carries a number of concrete, testable consequences:

- **Suppression of charge superposition.** In mesoscopic ring interferometry or Aharonov–Bohm setups, the DEQF phase current predicts an additional dephasing term proportional to $\lambda_e \kappa_e \rho^2$.

  $$\Delta\phi \ \sim \ \lambda_e \kappa_e \rho^2 \, L,$$

  where L is the interferometer path length. *Prediction:* dephasing at the level of order 10^{-x} in solid–state devices, testable against next–generation quantum interference experiments.

- **Quark confinement via triadic closure.** The $\mathfrak{su}(3)$ coherence current enforces a Z_3 closure condition on color triplets. *Prediction:* lattice QCD simulations should reveal a systematic bias in hadronization, favoring baryonic color-neutral combinations and suppressing unbound diquark states, consistent with a triadic coherence law.

- **Weak interaction asymmetry.** Broken chiral coherence manifests in the left–handed current $J^i_\mu = \kappa_w \rho^2 \bar{\psi}\gamma_\mu P_L \tau^i \psi$ ($P_L = \frac{1}{2}(1-\gamma^5)$). *Prediction:* precision electroweak observables will display small but definite deviations from $SU(2)_L$ symmetry at scales set by the coherence parameter λ_w, offering a natural route to the observed parity violation and W/Z mass splitting.

- **Dark matter as vacuum stress.** The virtual–graviton stress–energy $T^{(\mathrm{vg})}_{\mu\nu}$ contributes directly to the Trimm Equation. *Prediction:* in low-acceleration regimes, galaxies should exhibit effective dark-matter–like cored density profiles, with asymptotic rotation curves obeying

  $$V_c(r) \;\to\; \text{const.} \quad \text{for} \quad a(r) \lesssim a_\star, \qquad a_\star \sim \lambda_g \,\langle \rho_{\mathrm{vg}} \rangle.$$

  This provides a falsifiable alternative to particle dark matter by linking galactic dynamics to DEQF coherence pressure.

In sum, the GUFT framework portrays the four interactions as distinct dialects of a single principle: the universe's demand for harmonic coherence in its underlying substrate.

8 Conclusion

We have shown that the four fundamental interactions—gravity, electromagnetism, the strong force, and the weak force—can be unified within the Grand Unified Field Theory of Asymmetry (GUFT) as distinct manifestations of coherence geometry in the Dark Energy Quantum Field (DEQF). The Trimm Equation, a modification of Einstein's field equations incorporating the stress–energy of virtual gravitons, provides the analytic bridge that embeds relativity within quantum field theory and extends the geometric principle to all interactions.

In this framework:

- Gravity emerges as the curvature of spacetime coherence.
- Electromagnetism is the curvature of phase coherence.
- The strong force is the enforcement of triadic color coherence.
- The weak force is the management of broken chiral coherence.

Each interaction admits a field equation of the form

$$\mathcal{C}_{\mu\nu} = \lambda \, \mathcal{J}_{\mu\nu},$$

a structural parallel that reveals their unity as expressions of the substrate's demand for harmonic closure.

This achievement extends Einstein's vision. Gravity was the first force to be recast geometrically; GUFT demonstrates that all four interactions can be understood in the same way. The universe is not governed by disparate forces but by a single principle: coherence geometry.

Future work will develop the quantitative predictions of this framework, including suppressed charge superpositions, measurable signatures of virtual graviton density, and coherence-based constraints on electroweak mixing. These avenues open the way for experimental tests that can distinguish GUFT from the standard model and ΛCDM cosmology.

The GUFT framework thus not only unifies the four interactions but also offers a path toward resolving long-standing puzzles of physics. It reveals the universe itself as a coherent symphony, in which each note, each particle, and each field is sustained by the harmonic demand of the substrate.

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